

Evolution of EOSDIS, Science Data Systems and the DAACs



Ocean Color Research Team Meeting
April 14-16, 2004
Washington D.C.

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Program Executive for Data Systems
NASA Headquarters



Overview of Presentation

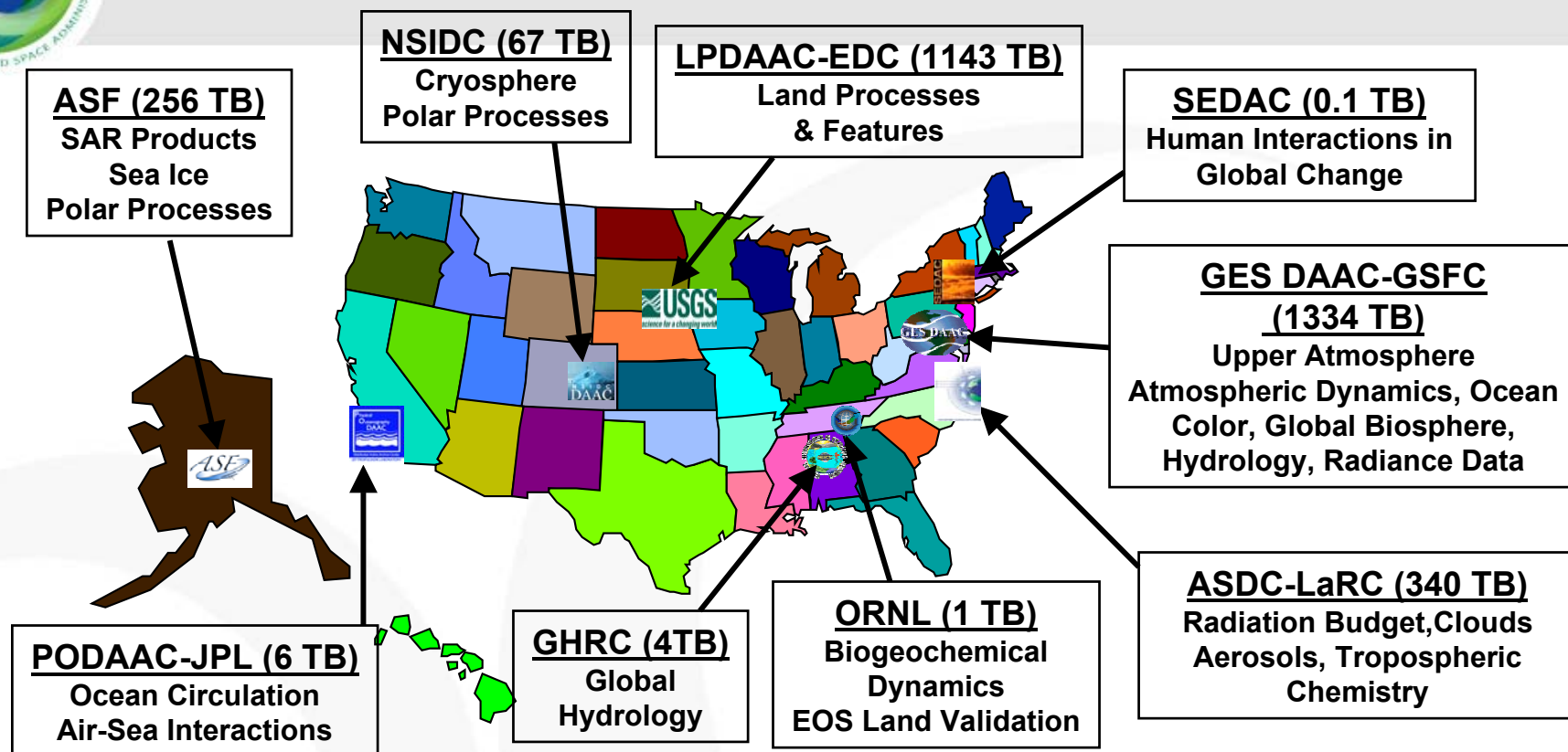
- ❑ Current state of NASA's ESE Data and Information System.
- ❑ EOSDIS elements and plans for evolution.
- ❑ The Ocean Color Data System - a prototype for understanding the elements of a measurement-based data system, and how such systems will drive evolution of ESE Data and Information System.







ESE discipline focused DAACs: Serving and Exploring Earth Science Data, Information, and Information Technology...as only NASA can



The DAACS:

- Focus on intelligent use of NASA's information through sound data management
- Ensure unencumbered distribution of NASA Earth science data to ALL users
- Provide complete user services and data expertise services
- Exploit advanced technologies to further facilitate the ESE mission





Drivers of Evolving NASA's Earth Science Data & Info Systems

☐ Missions to Measurements

- ☐ ESE is moving from mission-based data systems to those that focus on Earth science measurements.
- ☐ ESE's DIS will be a resource for Earth science-focused communities enabling research, and will be flexible, scalable and suited for the particular community needs.
- ☐ Continue on the pathways for acquiring observations to understand processes and develop Earth system models.

☐ The Advance of Information Technologies

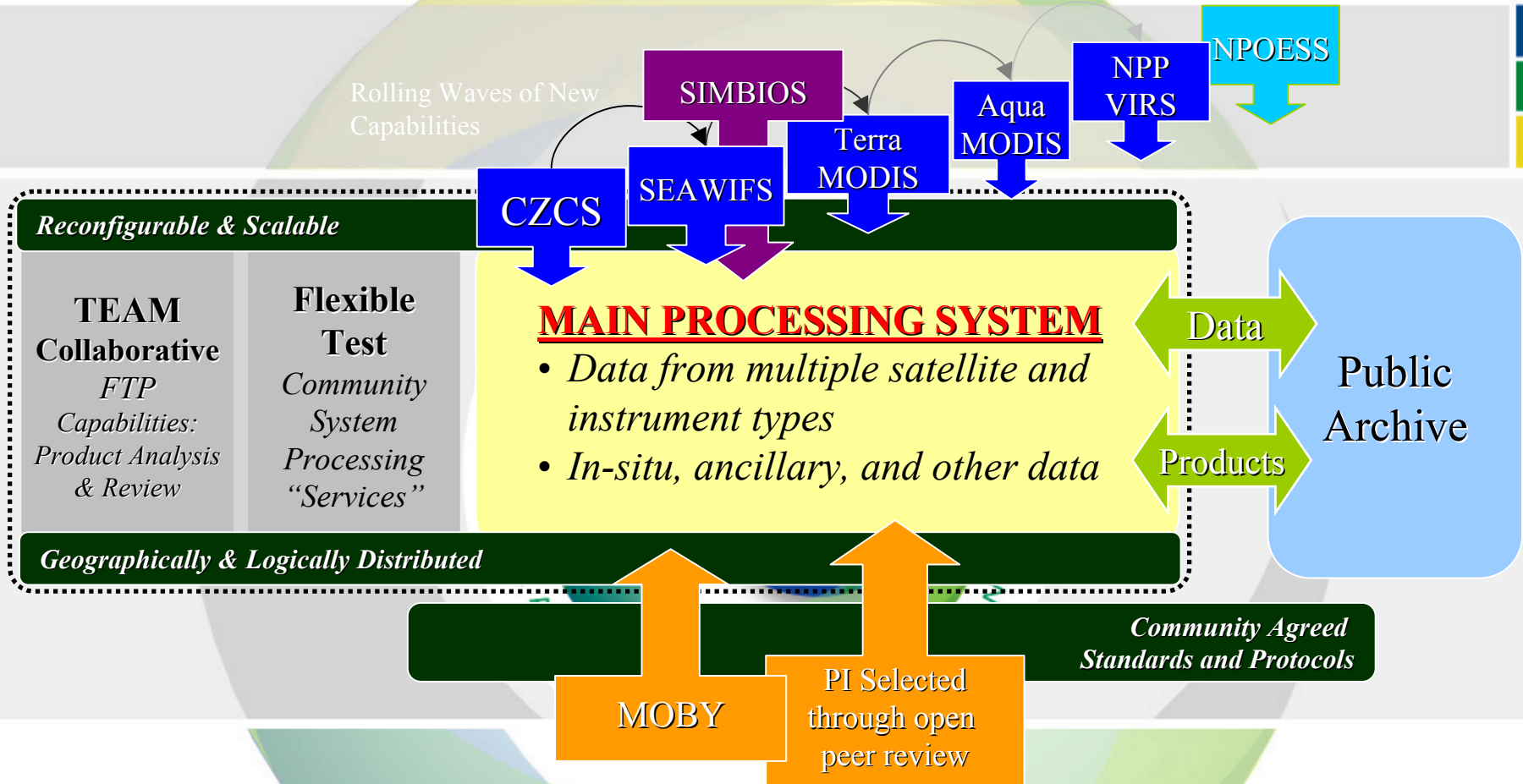
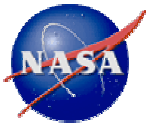
- ☐ NASA will remain at the forefront of IT development and will partner with other agencies to ensure the strategic use of IT resources to avoid obsolescence and enable enhanced performance.
- ☐ The lowering cost of IT infrastructure enables ESE data systems to take advantage of improving computation, storage and network capabilities.

☐ Facilitate the Transition from Research to Operations

- ☐ Work with Federal partners to transition operational elements of data systems to other agencies while maintaining core data system functions necessary for conducting NASA ESE mission and goals.



The Ocean Color Processing System



Processing embedded within the science focus areas
Distributed capabilities capturing "rolling waves"
Community, participation, consensus and community services
Move processing capabilities closer to the science teams
Engage expertise through peer review selection





Ocean Color & Precipitation Processing System (PPS)

Measurement System Findings

- ❑ Priorities set by ESE Research Science Program Managers in consultation with the funded measurement team & science community
- ❑ Requirements are science-driven based on the specific measurement needs and resource constraints
- ❑ Measurement team has science and system expertise to perform periodic assessments and trade-offs
- ❑ Measurement focus allows science research with seamless data sets across missions
- ❑ Measurement sets evolve via community collaboration
- ❑ Flexible and dynamic framework
 - To support a dynamic suite of standard and research products
 - To allow measurement system optimization for functionality and services provided
 - To support distributed functions with science collaborators
 - Negotiated support for common services to support measurement team





Key Drivers (Preliminary)

EOSDIS

- ☐ Level 1 requirements
 - Requirements set by HQ PEs and science PMs
 - Formal requirements control process
 - Fixed standard products
- ☐ Mission focus
- ☐ Broad user community with diverse needs
 - Infrastructure framework
 - Archives & stewardship
 - Networks for EOS and other missions
 - Media, electronic distribution
 - Data interoperability & access

Measurement Systems*

- ☐ Science driven requirements
 - Single science PM sets priorities
 - Local authority to make trades within resources
 - Dynamic product suite
- ☐ Measurement focus
- ☐ More cohesive community focus
 - Strong community partnerships
- ☐ Distributed functions
 - Tailored to serve primary community
 - Can leverage community inputs
 - Can rely on EOSDIS for common services





Preliminary Findings: Common Services

Support for Measurements Teams

- ☐ Data Archive & Stewardship
 - Preservation of climate data records & source data
 - Metrics & data accounting *
 - Data life cycle engineering
 - Long Term Archive Transition
- ☐ Distribution
 - Media (phase out in 3-5 yrs?)
 - More products on line
 - Repackage (reduce granule size, preferred formats)
 - User Services / help desk
- ☐ Infrastructure
 - Data capture and transport
 - Communication networks
 - Enable reuse *
 - Infuse technology *

Additional support for User Community

- ☐ Search & Access
 - Cross-discipline access to climate data records
 - Enable custom web portals
 - Broker data & services (e.g. ECHO)
- ☐ Standards*
 - Facilitate definition of common spatial/temporal grids
 - Facilitate open interfaces

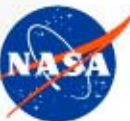




Data System Functions: Getting the Right Mix



- ❑ Measurement data system prototypes have established that scientific data processing and community distribution of products can be performed by the measurement teams.
- ❑ Making data available to broad user communities and interdisciplinary science may best be performed by NASA established data centers. “One size does not fit all” for system functions performance.
- ❑ Continuous optimization of the distributed system so that activities can be relocated to allow for the most efficient use of scarce resources, maturation of science data, etc.
- ❑ To ensure the ‘flow’ of data through a distributed, heterogeneous data system, the interfaces between the pieces become even more critical.
- ❑ Community-based standards and protocols can inform and be informed by inter-community working groups (ES DSWG domain specific functions).





Ocean Color (OC) Data Stewardship at the GSFC Earth Sciences (GES) Data and Information Services Center (DISC)

featuring existing on-line access, tape backup, data analysis tools, and full user services

→ = data flow

OCDPS:

Selected MODIS Oceans Color

OC REASoN
CAN (Gregg):

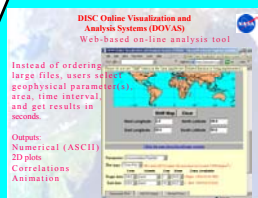
CZCS, OCTS, SeaWiFS seamless time series (Produced at OCDPS; Archive/Distribution at GES DISC)

On-line: OC REASoN CAN data
V0 OC data

MODIS OC data

Architecture:

- Low Cost on-line archive
- On-line visualization and analysis tools
- Direct data access



Data Services:

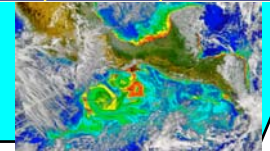
- Value added data services & tools
- Insertion of new technology to facilitate data management
- Continued data services evolution based on community needs
- Advances services that promote interoperability and interdisciplinary studies

User Services:

- Supports data access and usage by scientists, modelers, decision support systems, applications, students, international users
- Outreach



• Concepts • Missions • Data • Analysis • Community • Collaboration • Data Tools •



GES DISC
**Ocean
Color
Panorama**
a
Providing
Institutional
Data
Stewardship

~FY04

~FY05

~FY06

~FY07

GES DAAC
V0 System:

CZCS, OCTS, SeaWiFS

GES DAAC:

Tape Backup; No User Services

CZCS, OCTS, SeaWiFS seamless time series, heritage CZCS, OCTS, SeaWiFS, MODIS Oceans (from OCDPS), all MODIS Oceans data



Backup





Features of the GES DISC Ocean Color Community Services

- Data and metadata integrity ensured by consistency checking between metadata, database inventory, and on-line inventory
- Consistent version and filename control maintained
- Researcher data request and order tracking tools
- User query response tracking (User Assistance System).
- Convenient and customized (responsive to ocean color community requests) data access and ordering interfaces.
- Comprehensive and accurate mission and data documentation.
- Distribution on media (tape or CD-ROM) as a viable option to support ocean color-researchers from third-world and other technically less-advanced countries
- DAAC distribution methods, developed in collaboration and consultation with the SeaWiFS Project and NASA HQ, insures maximum, multi-tiered, distribution capability.
- Reprocessings conducted in a manner that minimized user confusion and reduces potential "mixture" of data versions, insuring data integrity and valid scientific results.
- For all archived data sets, the GES DISC Data Support Teams have a tradition of surmounting existing limitations to get data to users who need it





Ocean Product Distribution Statistics: GES DAAC

AQUA AND TERRA MODIS Oceans products distributed to USERS*

Monthly average for the last 6 months:

Number of orders: ~490 orders per month

Number of files distributed: ~75,000 per month

Number of Gigabytes distributed: ~1,175 GB per month

SeaWiFS products distributed to USERS

Monthly average for the last 6 months:

Number of orders: ~750 orders per month

Number of Gigabytes distributed: ~850 GB per month

* (Excludes distribution to MODAPS, and of radiance data and ancillary data associated with Oceans data)





Sampling of most popular MODIS Ocean products

MODIS/Terra Ocean Color and SST Mean Maps Daily L3 Global 4km
MODIS/Terra Ocean Color and SST Mean Maps 8-Day L3 Global 4km
MODIS/Terra Ocean Color and SST Mean Maps 8-Day L3 Global 36km
MODIS/Terra Ocean Color and SST Quality Maps 8-Day L3 Global 4km
MODIS/Terra Ocean Color and SST Quality Maps 8-Day L3 Global 36km

MODIS/Terra Ocean Color Radiance Products 5-Min L2 Swath 1km Day
MODIS/Terra Ocean Color Derived Products Group 1 5-Min L2 Swath 1km Day
MODIS/Terra Ocean Color Derived Products Group 2 5-Min L2 Swath 1km Day

MODIS/Aqua Ocean Color Radiance Products 5-Min L2 Swath 1km Day
MODIS/Aqua Ocean Color Derived Products Group 1 5-Min L2 Swath 1km Day
MODIS/Aqua Ocean Color Derived Products Group 2 5-Min L2 Swath 1km Day

MODIS/Terra Sea Surface Temperature Products 5-Min L2 Swath 1km
MODIS/Aqua Sea Surface Temperature Products 5-Min L2 Swath 1km





Features of the GES DISC Ocean Color Community Services

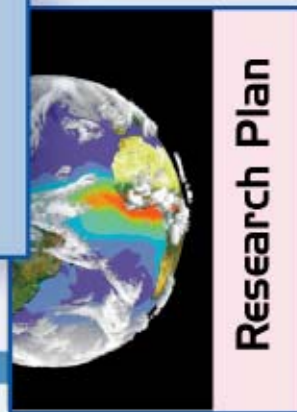
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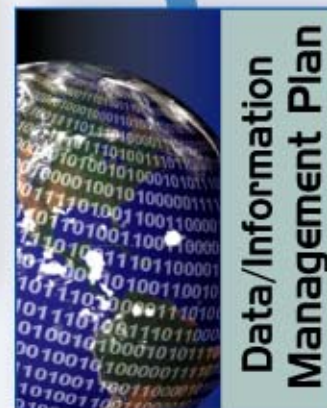
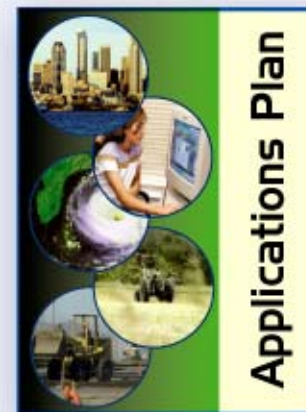


ESE Strategy Documents

ESE Strategy Documents

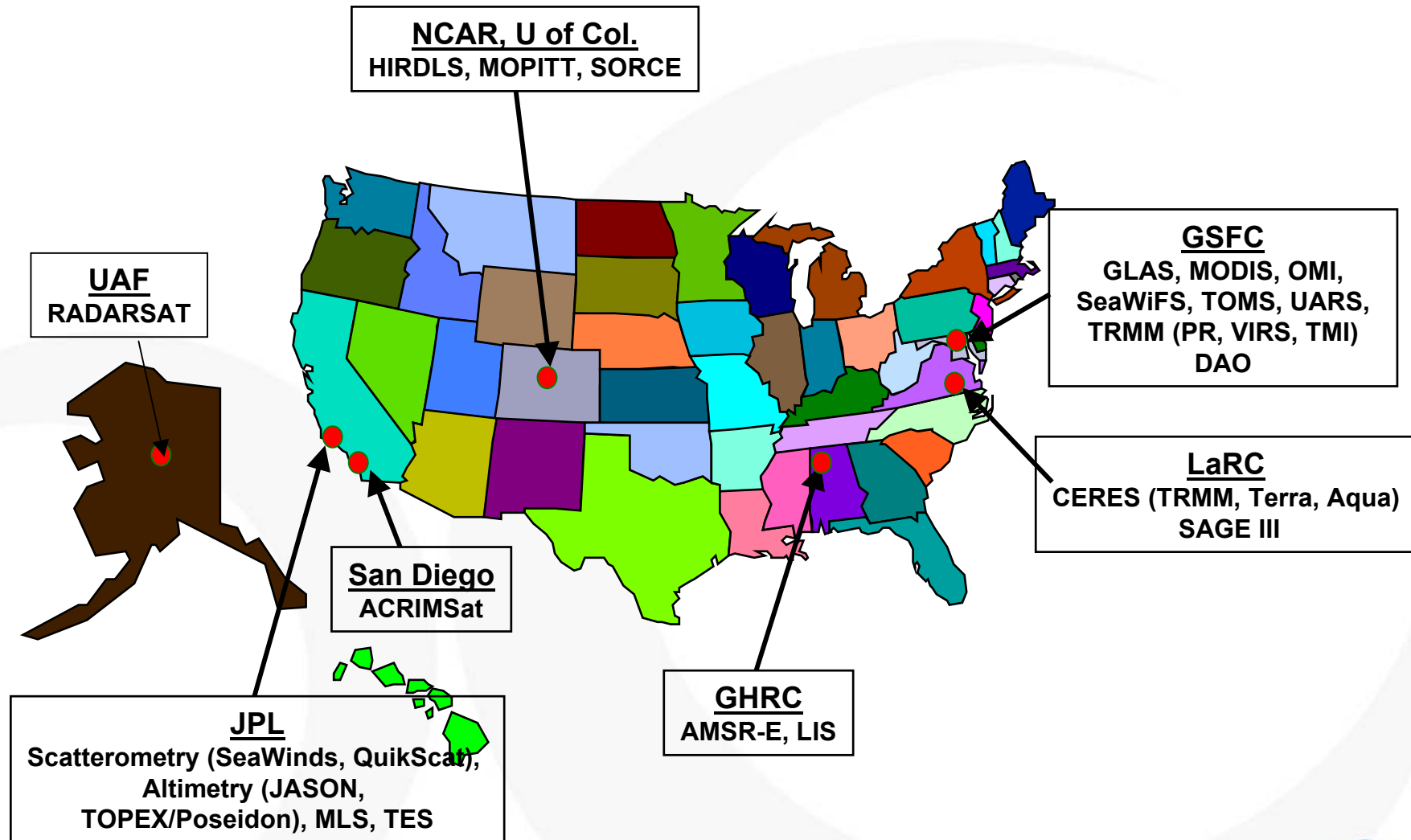


- Observing approach
- Computational modeling approach





ESE Funded Science Investigator-led Processing Systems (SIPs)





EOSDIS Science Operations

Science Operations components include:

- *Eight Distributed Active Archive Centers*
- *Global Change Master Directory*
- *EOS Data Gateway and EOS Clearing House (ECHO) Operations*
- *Interfaces with Science Investigator-led Processing Systems*
- *ESE User and Usage Metrics Collection and Analysis*
- *EOSDIS Contributions to the ESE Outreach Program*
- *Integration of cross-element collaborative activities:*
- *User Services Working Group, DAAC Outreach*

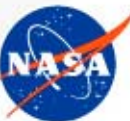
The EOSDIS Science Operations Office provides integration needed to accomplish the ESE data and information goals and objectives





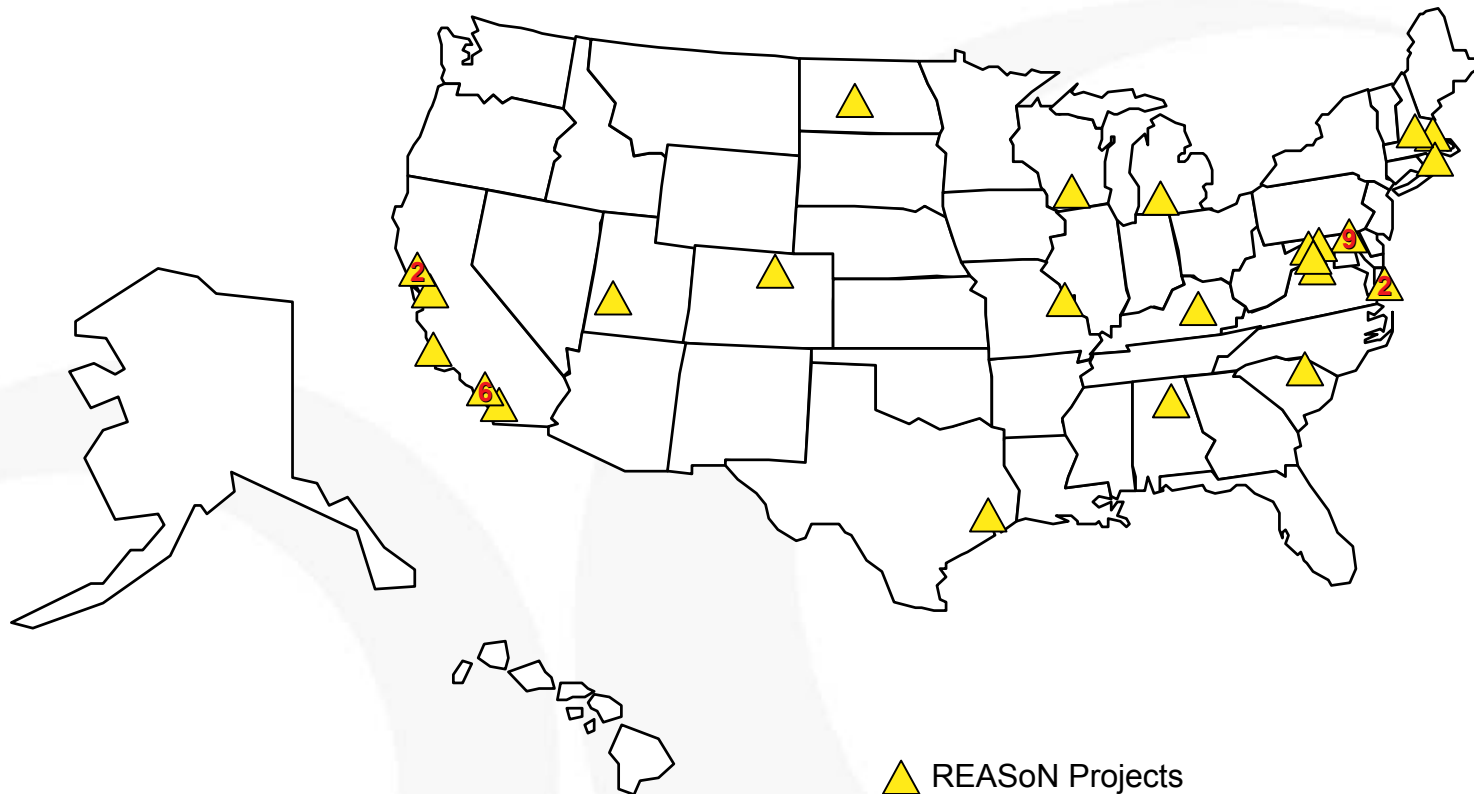
Evolution of EOSDIS

- ❑ Primary goal is evolution to meet the future ESE objectives and priorities
 - *Decompose* into functional elements
 - *Consider alternatives* to move towards a more distributed, heterogeneous data and information environment with a fully interoperable architecture
 - *Develop element options and action plan*
 - *Emphasize* science value and cost control
- ❑ Additional Goals
 - Increase life-cycle cost effectiveness
 - Increase end-to-end data and data system efficiency
 - Improve support for data utilization by end users
- ❑ Consider: ESE Prototype Measurement Systems, REASoN, Earth Science Working groups, ESTO, IT activities





REASoNs - Distributed and Heterogeneous



42 projects producing data and information and/or services competitively selected through the Research, Education and Applications, Solutions Network Cooperative Agreement Notice (REASoN CAN) for development of next-generation architectures.



Earth Science Data Systems Working Groups (DSWGs)

SEEDS Study
Recommendations

NewDISS
Document

- ☐ **Technology Infusion**
 - Co chairs: Karen Moe, ESTO, Rob Raskin, JPL
- ☐ **Metrics Planning and Reporting**
 - Co chairs: H. K. Ramapriyan, ESDIS, Paul Davis, University of Maryland
- ☐ **Standards and Interfaces**
 - Co chairs: Richard Ullman, ESDIS, Ming Tsou, San Diego State University
- ☐ **Reuse**
 - Co Chairs: Robert Wolfe, Raytheon, Steve Ackerman, University of Wisconsin
- ☐ Kick-off meeting held January 8, 2004 in Orlando, FL
- ☐ 88 registered participants
- ☐ Meeting open to all (as is done in IETF). REASoNs were represented.

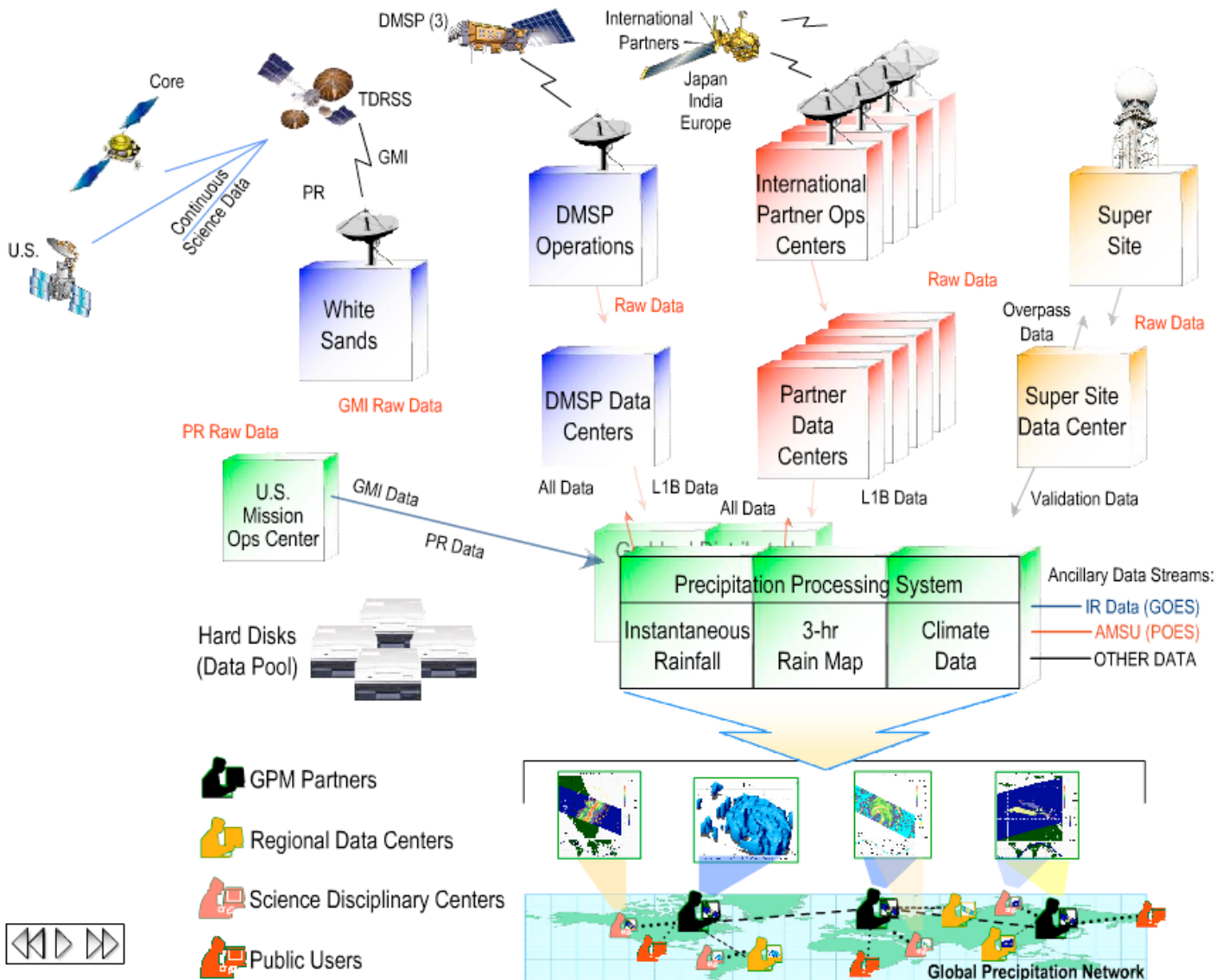


The Ocean Color Processing System





Precipitation Processing System





Systematic Measurements from NPP

